Breckenridge, Missouri
Water Supply Study
City Lake

Breckenridge is located near the Northeast corner of Caldwell County, Missouri. It is approximately 14 miles West of Chillicothe, just North of highway 36.

The record period of drought was used to estimate adequacy of Breckenridge's water supply during this period. The drought of record was determined to be during the 1950's.

The 30-year average rainfall, years 1970 to 2000, is approximately 37.5 inches. Rainfall at the Chillicothe gage was used in this analysis. For the period of the severest part of the drought of 1953 through 1957, annual rainfall was 20.07, 33.55, 28.27, 27.88, and 42.38 inches.

Breckenridge uses less than the 100,000 gallons of water per day. As a result, they are not considered a major water user and do not report their use to Department of Natural Resources. In years 2000 and 2001 Missouri public drinking water program registered 45,000 gallons per day and in 2004, 59,000 gallon per day. For this analysis 59,000 gallon per day was used. Optimum demand is 52,000 gallons per day.

Breckenridge Lake is located approximately 1 mile North of the city.

Breckenridge Lake Physical Data

Elevation (feet)	Area (acres)	Volume (acre-ft)	
780.0	0.3	0.1	
782.0	0.9	1.3	
784.0	1.4	3.7	
786.0	1.9	7.0	
788.0	2.5	11.3	
790.0	3.0	16.7	
792.0	3.7	23.3	
794.0	4.6	31.6	
796.0	5.6	41.8	
798.0	7.0	54.4	
800.0	8.3	69.6	
802.0	9.8	87.6	
806.0	13.7	130.0	Water Surface on April 5, 2004
806.5	14.3	140.0	Spillway
808.0	15.9	160.0	
809.4	17.7	190.0	Top of Dam

Breckenridge's Lake analysis consisted of using the NRCS's computer program "RESOP". This program analyzes remaining stored water at the end of each month by summing gains and losses.

Following is the data and procedures for input to the "RESOP" program.

STO-AREA Elevation-Storage and Elevation-Area data were determined from April 5, 2004 surveys of both lakes made by USGS.

LIMITS

Full Pool storage	140 Acre Feet
Minimum Pool storage	11.3 Acre Feet
Drainage Area	0.65 Square Miles

Starting storage was considered at full pool elevation.

GENERAL The adjustment factor of 0.76 to convert from Pan evaporation to Lake evaporation was applied prior to entering the data for the control word EVAP. As a result a factor of 1.00 is applied.

The record period of drought is in the 1950's. Analysis began in January 1951 and ending December 1959

SEEPAGE The reservoir seepage varied from 0 seepage near empty to a maximum of 1.00 inch per month at full pool. The material in the dam is compacted earth of clayey soils.

RAINFALL Rainfall data came from the Chillicothe, Mo. rain gage for the period 1951 through 1959.

RUNOFF Monthly runoff volumes in watershed inches were determined at the Jenkins Branch stream gage, a tributary to Platte River. The drainage area is 2.72 Sq. Mi. Jenkins Br. gage is located approximately 35 miles West from Breckenridge. The monthly runoff was compared to the rainfall and if the results did not appear reasonable, adjustments were made for that month by looking at individual rains and estimating antecedent moisture then adjusting runoff for each rain based on NRCS's runoff curve numbers.

EVAP. Pan evaporation at the Lakeside gaging station was used as a base because it has data for year around evaporation. This data was updated with gage data from stations at Spickard, New Franklin, and Columbia. Depending on the latest data for the station nearest to Hamilton. The adjustment factor of 0.76 to convert from pan to lake evaporation was applied at this step.

DEMAND Breckenridge demand came from records kept by “Missouri Public Drinking Program”. The latest value they have shows the daily use in year 2004 to be 59,000 gallon per day.

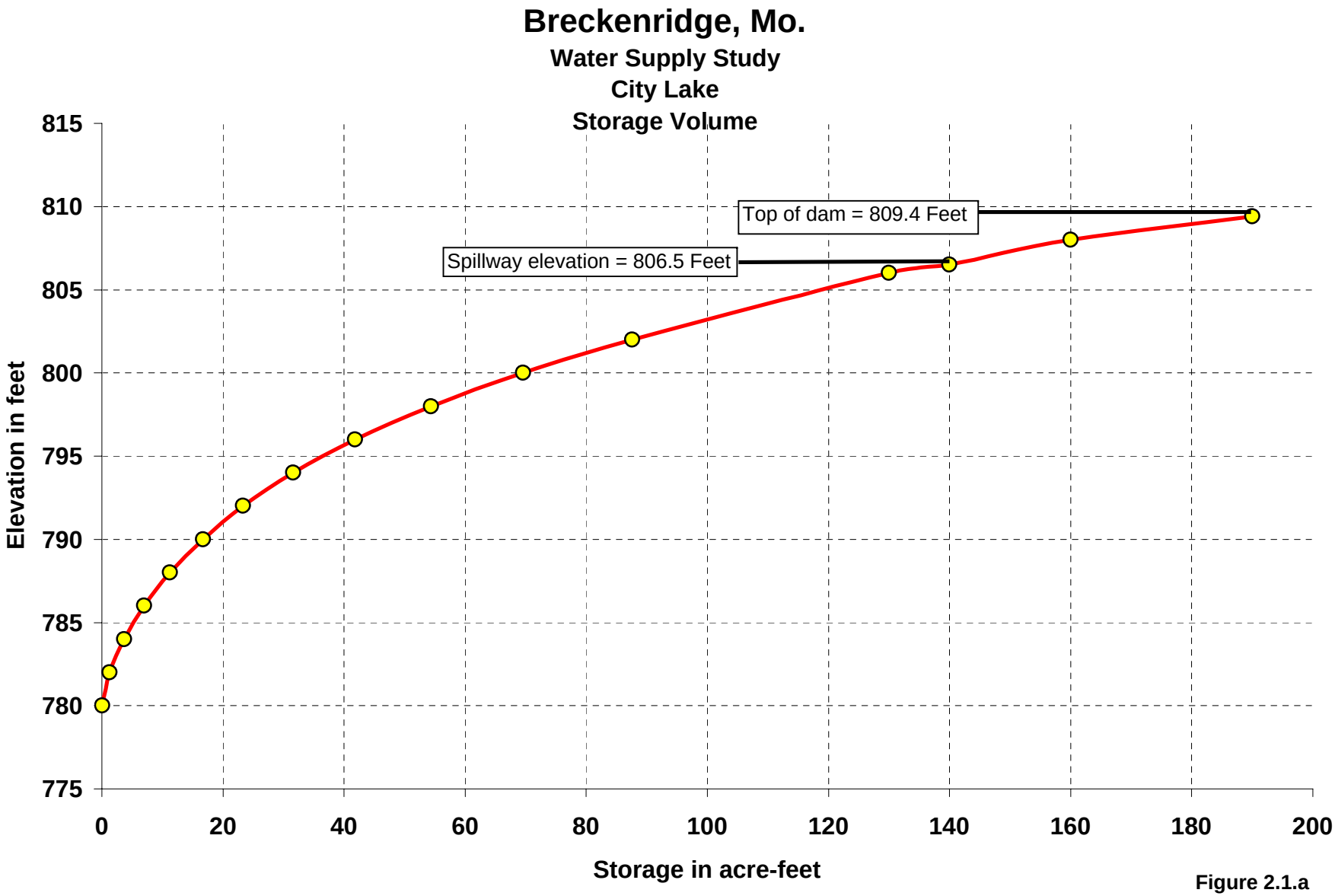
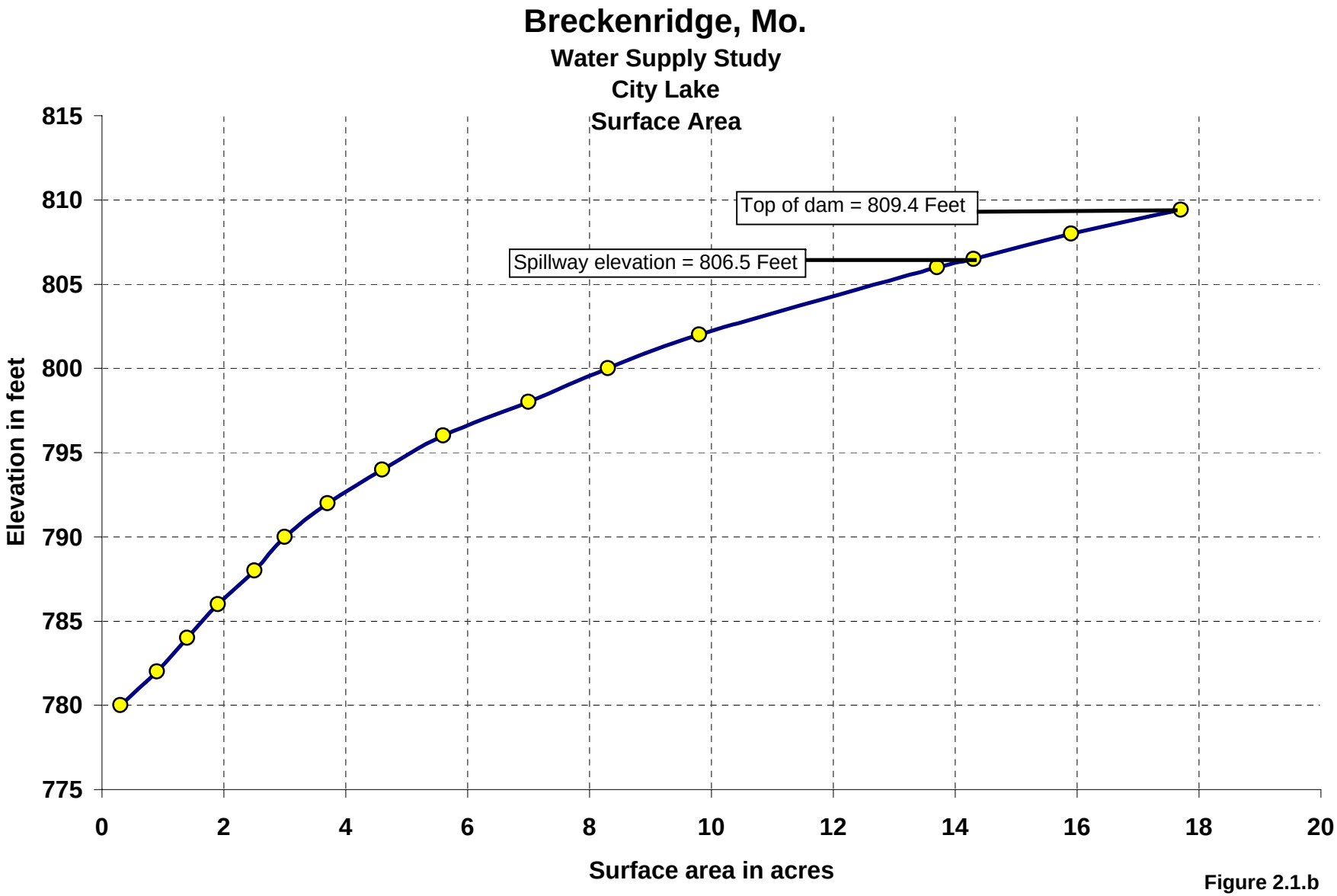

Breckenridge, Mo.
Water Supply Study
City Lake
Storage Volume
Top of dam = 809.4 Feet
Spillway elevation = 806.5 Feet
Elevation in feet
815
810
805
800
795
790
785
780
775
0
20
40
60
80
100
120
140
160
180
200
Storage in acre-feet

Figure 2.1.a


Breckenridge, Mo.
Water Supply Study
City Lake
Surface Area
Top of dam = 809.4 Feet
Spillway elevation = 806.5 Feet
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805
800
795
790
785
780
775
0
2
4
6
8
10
12
14
16
18
20
Surface area in acres

Figure 2.1.b

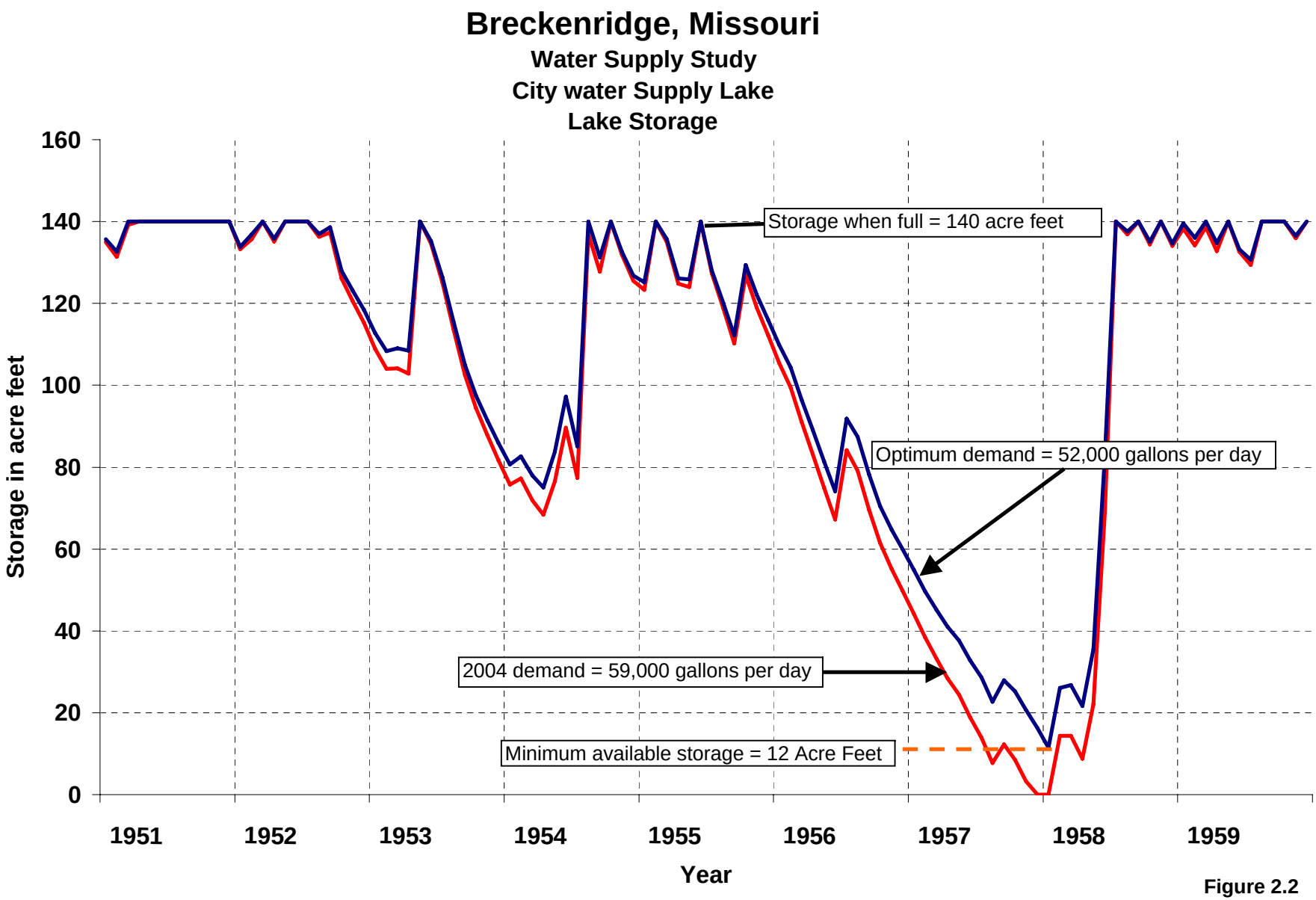
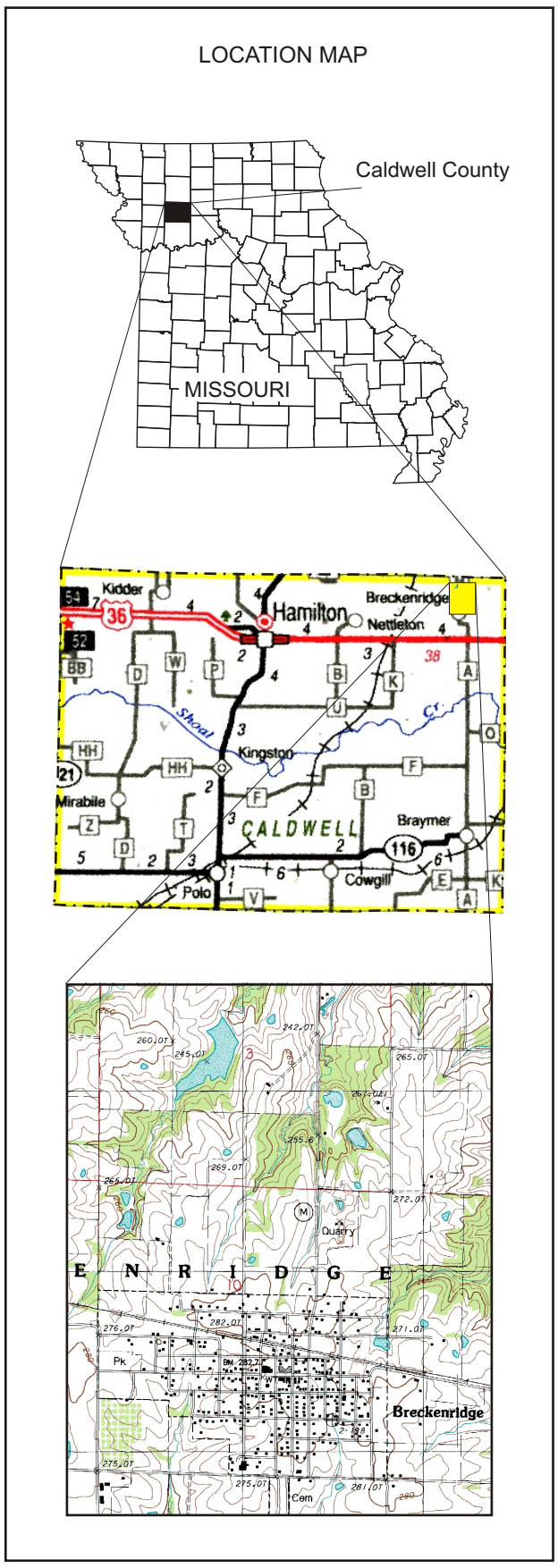

Breckenridge, Missouri
Water Supply Study
City water Supply Lake
Lake Storage
Storage in acre feet
160
140
120
100
80
60
40
20
0
1951
1952
1953
1954
1955
1956
1957
1958
1959
Year
Storage when full = 140 acre feet
Optimum demand = 52,000 gallons per day
2004 demand = 59,000 gallons per day
Minimum available storage = 12 Acre Feet

Figure 2.2

BRECKENRIDGE LAKE



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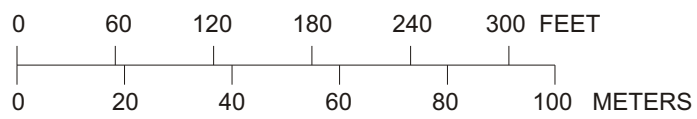
802.0	9.8	87.6
806.0	13.7	130
806.5	14.3	140
808.0	15.9	160
809.4	17.7	190

Table 28. Lake elevations and respective surface areas and volumes. Top of spillway structure is 806.5 feet and approximate top of dam is 809.4 feet. Elevations referenced to North American Vertical Datum 1988 (NAVD 88).



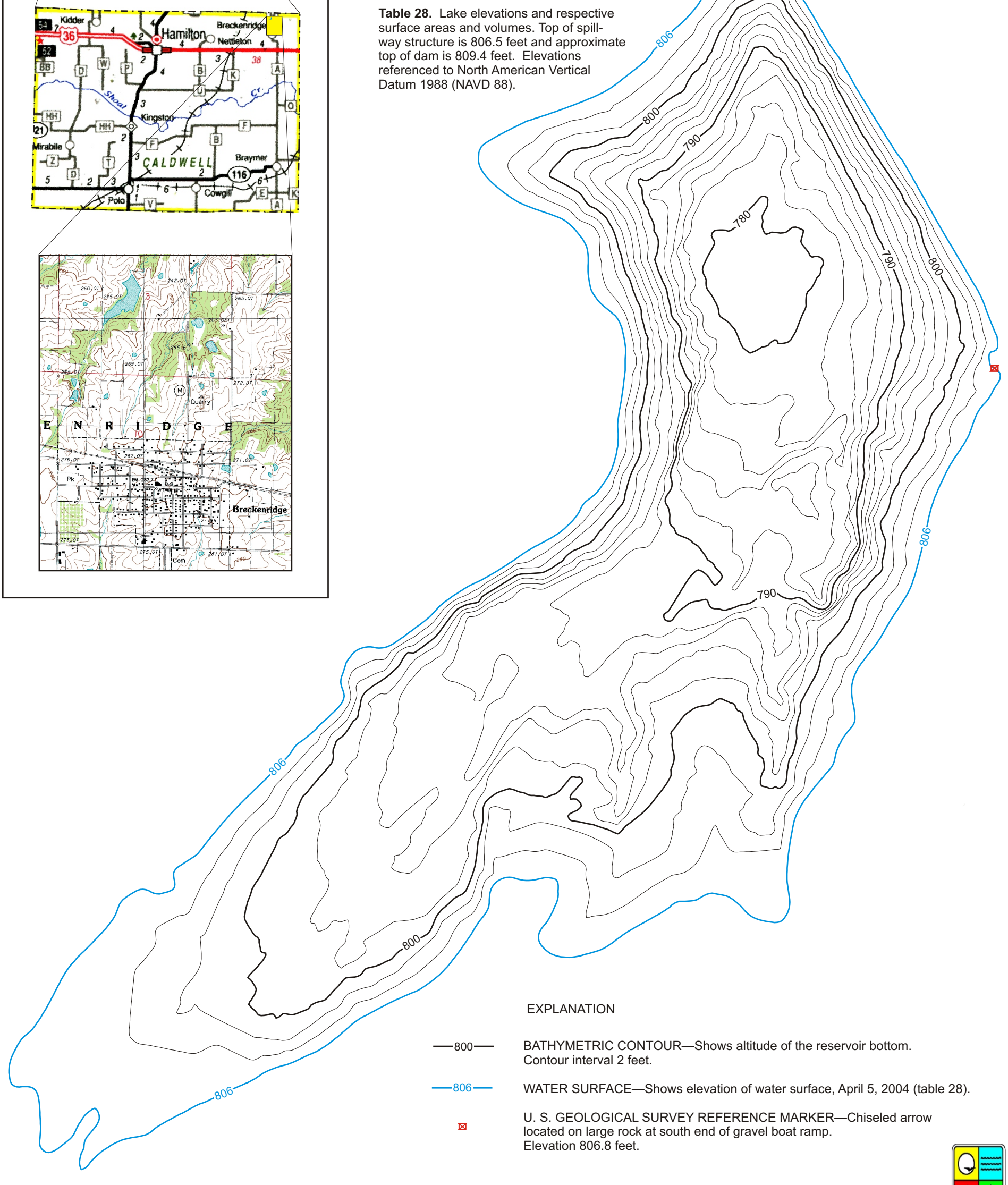


Figure 28. Bathymetric map and table of areas/volumes of the Breckenridge Lake near Breckenridge, Missouri.

In cooperation with Missouri Department of Natural Resources